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BUSINESS AND SCIENCE

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The eagerness with which American business men hasten to avail themselves of the newest scientific inventions and discoveries has produced two interesting results: first, the development of an extensive system of by-product industries; second, the creation of a sharper difference between the upper and lower grades of employment. Both of these changes have affected the field of University education. The perfection of industrial chemistry has brought with it the by-product, and the by-product has revolutionized manufacturing industry. This is the age of "allied" and "auxiliary" businesses in both industry and commerce. The growth of by-products has caused a demand for two different classes of men, technical experts or specialists and executive and commercial managers or "developers." The popular belief is that this is the era of specialization, but the field of the narrow business specialist is at present neither very profitable nor extensive. The technical expert who is employed to solve a limited class of problems is not the man who determines policies or guides enterprises. He may or may not be well paid, but he does not furnish the highest nor the most appreciated service to the undertaking. The indispensable man is he who can use the services of the specialist to develop new fields and open new opportunities for the business.

The common fallacy is to suppose that each corporation makes a specialty of one business,—that the more narrowly and closely each specializes, the better and more salable its product,—and the more intently each individual officer limits and concentrates his efforts within a given scope, the greater his success and his value to the corporation. "Let the shoemaker stick to his last" is the generally accepted view. It corresponds to a theoretical world in

which each step forward in economic progress is achieved by the formation of some new concern which concentrates its huge wealth upon the production of a single article. A system of education built upon this theoretical world as a basis would be subject to practical earthquakes. For the meat-packers sell soap; the gas company makes roofing pitch; the asphalt business includes the management of a winter hotel and the oil interests sell bank credits. The success of the department store is a standing protest against the theory of specialization. Each store supplants numerous special shops; its various departments do not succeed by devoting their attention to individual wares, but by developing or suggesting many new wants. The jewelry department profits from its residence under the same roof with the bookstore; and the sale of notions is reinforced by the café. Why should a firm spend large sums in advertising to attract customers to its establishment, but compel them to leave the building for luncheon? Why should a "shopper" leave the building at all? Hence the restaurant, the concert, the lecture on some interesting topic, the exhibition of paintings and war relics, the sleight of hand entertainment, and even the miniature circus performance in the department store. A specialized shop cannot compete because it is founded on a principle which is no longer applicable.

The production of oil has led to an especially interesting series of auxiliary enterprises. Crude and refined oil, petroleum jelly, gas, gasoline and light oils, fine and heavy lubricating oils, wax, paraffine, chewing gum, oil cake, barrels, tin cans, bags and wooden boxes are all manufactured in the various departments and plants of the industry. In addition, it has proved profitable to own and operate banks, steamship lines and various other commercial undertakings. The asphalt interests own or operate asphalt beds, paving companies, vitrified brick plants, paving-tool and implement factories, mines, trolleys, telephones and resort hotels.

In gas manufacture, tar, briquettes, light and heavy oils, dyes, creosote and coke are resultant by-products leading to the development of new markets and new departments of the business. The most successful meat-packing concerns have been directed by men who were able to develop extensive "allied" industries. Besides the usual dressed fresh, canned, dried and smoked meats, the packing interests manufacture soups, meat extracts, sausages, lard, toilet-

laundry- and wool-soap, gelatine, pepsin, glue, fertilizer, etc., and operate printing establishments, can, box and paint factories, extensive refrigerator car lines, and meat, fruit and vegetable refrigerating plants. In addition to the manufacturing side of the business, a wholesale organization has been built up which distributes some of the products throughout practically the entire domestic market.

Another instance of the faultiness of the impression that business success is won primarily by specialization may be seen in the field of railway management. The railway is commonly supposed to be the most highly specialized undertaking in the United States; yet it is one which requires a great breadth of view and the highest ability to develop widely varying resources. Many railway companies devote the most careful attention to the settlement of new business enterprises along their lines of traffic; they collect and distribute information concerning the cost of land, taxation, labor markets, freight rates, etc. As an example, let us take the efforts of such a line as the Erie to develop new business in the wonderfully fertile industrial field between New York and Chicago. This district comprises parts of the states of New York, New Jersey, Pennsylvania, Ohio, Indiana and Illinois. The railway must convince manufacturers of the unusual advantages presented by this territory as a location for plants. To do this, the company through its industrial department has all the territory which is traversed by its lines districted in relation to resources, markets, hard and soft coal, gas fuel and other advantages for manufacturing, etc., it advises the manufacturers as to suitable locations and furnishes full information concerning local conditions.

These familiar instances show that while specialization is necessary to develop the chemical, engineering or technical side of industry and commerce, an entirely different kind of effort is required on the commercial and executive sides. Many a business which is popularly thought to rest upon the basis of specialization is, on the contrary, being developed as a series of interdependent and allied industries.

It is amid these new conditions that the man of broader viewpoint and superior mental training finds his most favorable opportunity. The expansion of the horizon creates a demand for new types of men. Those who are not prepared for the changed condi-

tions are by no means useless, but they are not available for the executive and creative work of the larger field. In the executive and commercial departments of each individual undertaking the degree to which narrow specialization is necessary frequently grows less as we mount in the order of official rank. The mechanical day-worker has only the most limited field of activity; the book-keeper, salesman and clerical helper are only slightly superior in breadth of scope, but with the superintendents and managers a different kind of activity is required. The problem confronting these latter officials is how to devise, establish and maintain new opportunities for the expansion of the business and the reduction of costs. The specialist is as incapable of doing this as the manager would be of doing the specialist's work. From this changed condition of modern industry it follows that the young man who is looking forward to a business career should decide whether he wishes to take up a technical specialty or to engage in the executive or commercial side of the enterprise. If the former, then his preparation should be directed along the lines of his specialty in chemistry, electrical, civil or mechanical engineering. If his work is of an executive or commercial character, he should be prepared for these important fields with as much care and thoroughness as for that of the technical department.

This last thought suggests the second change which is taking place in all forms of American industry and commerce,— the growth of a sharper distinction between the upper and lower grades of employment. The "industrial revolution" so-called is usually placed at the close of the 18th century, when a series of inventions in spinning and weaving and the development of steam-power industry impelled the laborer of the time either upward or downward in the economic scale. He was obliged to conquer for himself the position of an independent employer or to fall into the large and growing class of dependent employees. These inventions ultimately gave rise to a separate labor class, and developed the labor problem as we know it. But in reality this was only the beginning of a series of revolutions which have taken place with each new group of inventions in individual industries and establishments, and have not only widened the gap between employer and employee, but have created sharp lines of distinction between different grades of the employed class. The chief of these distinctions is that between

administrative or executive positions and other kinds of employment. Such a difference is recognized in countless ways,—in remuneration, social standing, personal views, hostility of organized labor, etc. The entire attitude of mind and point of view of the business executive are different from those of other employees; he must have an outlook over an entire department of the business. Those who through special ability and opportunity secure a foothold in the upper grades of employment are enabled to advance to the higher and even the highest executive positions, whilst those who fail to obtain this initial advantage, only span the gulf which separates them from the others by some unusual combination of effort and circumstance.

Furthermore, the difference between these two grades of employment is intensified by the already described specialization in the lowest rounds of business service. Such specialization not only prevents employees from learning all sides of an undertaking, but too frequently unfits them for the management of a whole department or enterprise by confining and limiting their sphere of action during the period of life when a broader habit of mind can be formed.

The young man who now enters industrial life with even exceptional ability therefore often finds his development seriously retarded by the inertia of routine in the lower positions and by the growing tendency to make a distinction between executive and other work. The employer cannot be expected to turn his establishment into an educational institution for teaching the broad and fundamental principles of his business. Yet these principles must be learned by the men who are to be the future managers and directing heads of the various departments in the concern. Banking does not consist of the operation of an adding machine or the running of a ledger. Merchandising is not the keeping of a stock list; railway management is not the carrying of a surveyor's rod, nor does manufacturing consist solely of mechanical drawing. Yet such is the character of the routine work which young men are very properly required to perform upon entering industrial or commercial life.

It is from these conditions that the need arises for some agency which will lift the beginner in business from the position of a routine automaton to that of an alert and intelligent though subordinate factor in the business organization and render him capable of

seizing opportunities for greater usefulness and promotion. Such an agency is offered by the University.

The beginner who has a proper University training may run the adding machine or perform the other routine duties with no greater success at first than the man who has not made a preliminary study of his field, but the relation of his routine duties to the entire business is better understood by the former, and these duties represent to his mind an intelligible and coherent part of a great business enterprise. In short, higher education for business should prevent the mass of necessary routine from obscuring the business principles which are being applied. The man who runs the adding machine, if he is to become eventually an acceptable candidate for promotion to higher positions in the bank, should familiarize himself not only with the checks which he is handling but also with the clearing house system, with bank deposits, the principal legislation affecting banks and trust companies, bank loans, circulation, etc.

Every beginner, no matter how great his education, must serve an apprenticeship in the lower rounds of business, but those who have no knowledge of business principles before entering upon the apprenticeship are apt either to gain a costly experience at the expense of the undertaking or to be relegated permanently to routine work. In the words of an official of one of the largest railways in the West, "No doubt a great deal of the shortsighted railway construction and expensive errors in maintenance and operation have been due to the lack of proper and systematic training; in other words, railway officers have been educated at the cost of the property."

Hitherto the application of science to business has been confined to the mechanical or technical sides of manufacture and commerce. Men's minds have been turned almost exclusively to the invention of machines and processes, the perfection of plant and other purely physical features of production. In these fields of effort the great triumphs of modern science over material obstacles have been won. But an equally great opportunity for the application of scientific principles exists on the side of business methods and management. The national and even international scope of industry to-day requires a far greater degree of perfection and accuracy in management than was formerly necessary or possible under the old system. The existence of this opportunity suggests a fundamental question:

Are there industrial, commercial and financial sciences — or scientific principles — capable of being applied to these branches of human effort? It will be admitted that the relation of the University to the business world depends upon the answer to this question. If such business sciences do exist and are capable of being taught in our institutions of learning, then the sphere of our great Universities is far broader than has heretofore been conceived. If such sciences do not exist, the rôle of the College or University is restricted, so far as business is concerned, to a simple general course. The possibility of teaching such sciences is therefore of cardinal importance in the development of a corps of trained men for the direction and management of large industrial enterprises.

When the manufacturer establishes a department of accounts, tries to trace his exact costs of production, makes contracts for purchase or sale, reorganizes a department of his plant, borrows money, considers market conditions and seeks favorable transportation rates, he confronts a series of problems which, in spite of the prevailing opinion, are not exempt from the usual laws of cause and effect, but are governed by certain influences and tendencies which may be studied, arranged and classified. His decisions on all these points are not made by some mysterious or erratic process of divination, but are governed by fundamental rules and maxims. The manufacturer may even observe these principles unconsciously, either from habit or because he has never voluntarily and formally codified them. But such rules and principles do exist and are followed, none the less. The work of each manufacturer in solving his own problems is repeated countless times by others. With slightly different circumstances of time and place and magnitude, some calculations must be made repeatedly in all parts of the country where such business exists. But is the experience so gained worth nothing to others? Is a correct decision on all these points the result of a mere whim of chance, and must each succeeding generation begin entirely anew the great scientific process of industrial organization and management, inheriting and bequeathing nothing toward the perfection of our economic system? Certainly the very statement of these questions affords their answer. The business man works out and follows definite, well-established principles. That they may be examined and ascertained is no longer a matter of question. The principles of transportation, credit, finance, business law, account-

ing, industrial management, insurance, etc., have all been arranged in systematic logical order and taught with precision.

Another instance, from the field of accountancy: the Accounting Department of a great undertaking is the intelligence bureau of the industrial army. It gives what is often the only reliable information which the proprietor can secure about his affairs. The difference between success and failure is often a difference between good and bad accounting, between accurate and inaccurate knowledge of the costs of production in different branches of the undertaking. One of the chief practical difficulties in the way of securing accurate returns is the problem of depreciation of plant. How much should be charged off for depreciation? Numerous instances are familiar to accountants in which the failure to rate this amount properly has led to a complete misunderstanding of the financial conditions of the enterprise. The danger is much greater in industries in which the machinery, tools, etc., form a large or a variable proportion of the capital outlay. The three methods generally employed are:

- 1st, to charge off an arbitrary amount each year.
- 2nd, to reckon annually a fixed proportion of the cost price.
- 3rd, to charge a certain percentage of the diminishing value of the machinery in such a way that, as the item of repairs rises, the depreciation charge decreases.

The relative value of these three methods can only be ascertained by a careful examination of the principles which govern their application under widely varying conditions. These principles, having been definitely ascertained from the experience of accountants, can be scientifically discussed in a University class-room and brought into proper relation with other important parts of the subject. The student who expects to enter either the manufacturing industry or the profession of accountancy or who, as a banker, may be asked to loan money on the basis of the valuation of a manufacturing plant, should certainly familiarize himself with the principles to be applied in the solution of such a problem.

The periodical bank statement with its items of reserves, loans and deposits has for the business community a significance which can be brought out clearly in the class-room. The relation which this statement bears to the amount of money available for loans for industrial and commercial purposes is such as to make it a valuable

indication of the changes and fluctuations of credit. In the field of transportation the various rail and water systems of the country should be studied by those who wish to enter either the railway business or any branch of industry which may involve an extensive movement of freight. Not only must the lines of transportation be studied, but also the economic geography of the various districts of the country with their products and economic facilities. A manufacturer with large railway interests, in writing of the importance of railway geography and shipping routes, says, "I have frequently noticed a lamentable want of knowledge, upon the part of young men in offices, of the simplest matters of the kind; comparatively few young men entering business really possess the most superficial knowledge of the railroad systems of their own states. The Transportation Department of any business is yearly becoming more important and is conducted upon a more scientific basis than formerly, so that it would seem a fitting course to be handled by an educational institution."

Such should be the character of the training of one who is to be employed in the administrative or executive work of a business enterprise. In all the fields of study mentioned and in many others, scientific treatises on the principles applicable to each branch of industry and commerce are appearing; the business reports, accounts, records and other material are being collected and systematized, and the methods of instruction perfected. Business science is no longer the dream of an enthusiast but an accomplished fact, and its results are now being rapidly brought to the service of the leaders of industry and commerce.

Finally the development and application of business sciences and their inclusion in the University curriculum have placed us in a position to cope with one of the great problems of modern American business, viz., the shortening of the period of active business life. With the concentration of business capital, the application of new inventions and the consequent demand for new types of men, there has come a new tendency to entrust to younger men the executive work of large industrial and commercial plants. The first few notable instances of this change were regarded as purely fortuitous, but the same thing has recurred in nearly all the large industries of the country until it is now seen to mark an essential and important change in conditions. The new system has obvious disadvantages.

It creates an unsteadiness or uncertainty of employment in the higher rounds of commercial life, and limits the practical usefulness of those who have passed beyond a certain age. We may even doubt if the change is a permanent one.

Its causes have been variously ascribed to the general inability of men who have developed under one industrial system to conform rapidly and successfully to a new set of conditions, or to the gradual nervous and physical breakdown of men in executive work, incident to the growth in magnitude of business enterprises, or to the ancient and amusing, but harmless, delusion that "competition in all walks of life is growing fiercer than ever before" and that only the younger men can stand this new strain.

But whatever its causes and disadvantages, the new age limit must be reckoned with as an important feature of our industrial system. If the period of active work in executive positions is to be shortened, those who enter such work have imperative reasons for starting out with a more thorough mastery of the business sciences which are applicable to the undertaking. The shorter the period of activity, the more complete must be the preliminary training and equipment. Here again it must be insisted that no amount of practical experience can be substituted for such a scientific preparation. The rise of business sciences in our great Universities means precisely that the fruits of years of business growth and experimentation in the widely varying undertakings of an industry are collected, compiled and codified. Therefore if such sciences are taught as they should be taught, the student has at his command a review of facts and principles such as it would take him decades to acquire in the routine work of a business house. Heretofore it has been the belief of many business men that their sons "cannot afford the time" to take a College course. The advent of the University in the field of commercial, industrial and financial science means that a young man cannot afford the time to learn business in any other way.